

Young (D. W.)

CHOLERA INFANTUM:

ITS

CAUSE, PATHOLOGY, AND TREATMENT.

BY

D. W. YOUNG, M.D.,

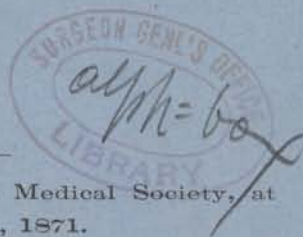
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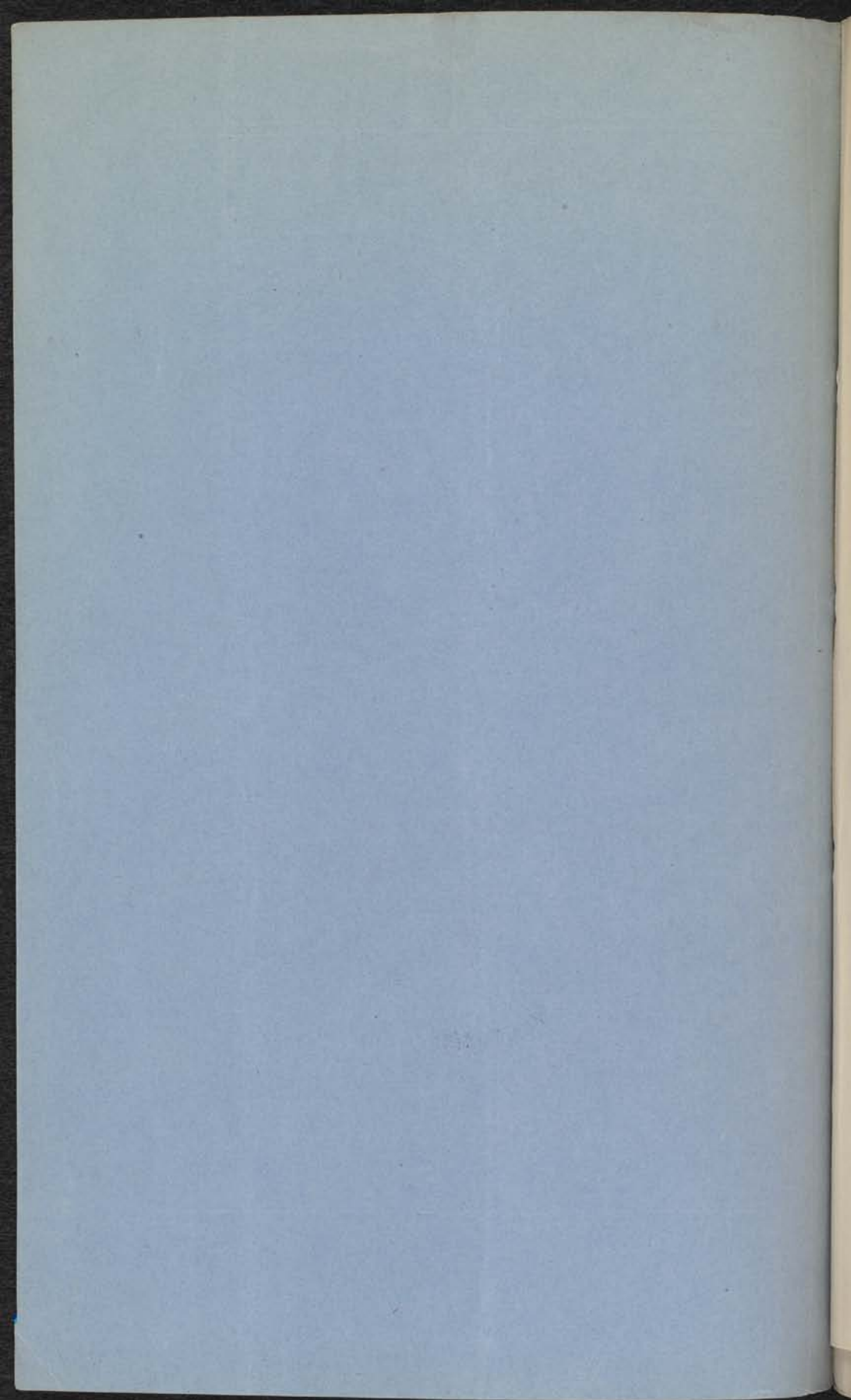
Read before the Illinois State Medical Society, at
Peoria, May 18th, 1871.

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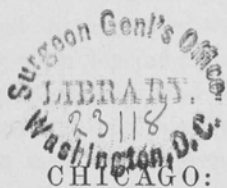
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THE HISTORY OF THE

REIGN OF CHARLES THE FIRST

BY JOHN BURNET

The first part of this history is divided into three books. The first book contains the reign of Charles the First from his birth to his death. The second book contains the reign of James the First from his birth to his death. The third book contains the reign of Charles the Second from his birth to his death. The second part of this history is divided into three books. The first book contains the reign of Charles the First from his birth to his death. The second book contains the reign of James the First from his birth to his death. The third book contains the reign of Charles the Second from his birth to his death.

REPORT ON CHOLERA INFANTUM.

MR. PRESIDENT AND GENTLEMEN OF THE SOCIETY:

I believe it to be a generally conceded fact that more children die annually from cholera infantum than from any other one disease known to the medical profession. If this be correct, does it not, then, clearly behoove us, as a profession—guardians of human life and public health—to put forth every effort to learn more concerning the cause, pathology, and treatment of this grave infantile malady?

I assure you, Mr. President and Gentlemen, that it is only under a full belief of the correctness of the above proposition that I have consented to occupy the valuable time of this Society for a few brief moments in the examination and discussion of this subject. The importance of the question is my only apology.

I frankly confess, however, that I enter upon the discussion with great distrust as to my ability to do it that justice its importance demands. I dare not for one moment arrogate to myself sufficient ability or ingenuity to promise you anything entirely new concerning either the disease or its treatment. In fact, the subject seems to be almost exhausted, by the efforts of the most eminent and distinguished writers of this and foreign lands. There are yet, in my judgment, certain questions concerning its etiology, pathology, and treatment which are well worthy of further research and inquiry.

Cholera infantum may very appropriately be defined, an endemic of the tenderest age, making its appearance exclusively during the hot weather of summer and early autumn, and being characterized by vomiting, purging, great prostration, exhaustion, and very rapid emaciation.

This disease chiefly occurs between the ages of two months and two years, also earlier and sometimes later, and is doubtless one of the most fatal affections to which infancy is exposed. The duration of cholera infantum and its *sequela* varies from a few hours to several days, weeks, or even months, according to the idiosyncrasy of the patient, the nature, severity, and more or less continued action of the causes and conditions that produce and continue it.

CAUSES.—Nearly all writers upon cholera infantum agree that the combined or correlated action of various remote and proximate causes are requisite in order to develop the disease. The conditions enumerated by most of them as being necessary for the production of the disease are mainly a high atmospheric temperature, confined and impure air of large and overcrowded cities, improper diet, and a certain infantile age, representing both the period of dentition and that of the physiological development of the muciparous follicles in the intestinal tube.

Now, it has long been a query in my mind whether we are not recognizing and considering too many causes, and thereby overlooking and losing sight of the real cause. Another equally important query with me is, whether the initial impression of the cause acts first upon the nervous, the digestive, or the circulatory system; whether the purging and vomiting are primary or secondary; whether they are the disease or simply symptoms? I at least claim this as a debatable question. I am not satisfied with charging dentition as an exciting cause; it is at least alleged by most, if not by all writers, to be an important predisposing cause; is regarded and rated by various excellent writers as the *conditio sine qua non* of the disease, without their telling us how or wherefore. Indeed, it seems as though it had been highly convenient for writers to look upon and pronounce dentition a predisposing cause of cholera infantum, without any further consideration, reflection, or evidence. Very probably Dr. Williams had in view this fact when he said: "The fact is simply that the division of causes ordinarily adopted among pathologists is conventional and convenient rather than natural and philosophical." I would say, what should be called and

recognized as causes are really circumstances that are essentially and invariably antecedent to disordered action.

The growth of the teeth at this particular time and age of the child is only a coincident of corresponding growth or development in the whole digestive canal; is a strictly physiological process, and not an abnormal or diseased one. Again, the teeth of children are growing at all seasons of the year—in January as much as in July. Hence, whatever diseases arise therefrom would be as liable to occur at one season as another; it is also not even claimed that the teeth produce cholera infantum, save in the hot months, when the atmospheric temperature ranges above 70°. Now, I ask, is it reasonable to assume and assert that the natural and gradual growth, development, and protrusion of the teeth produce any serious disease whatever? We know that the gum is a structure neither endowed with a high degree of sensibility, nor largely supplied with nerves of extensive sympathetic relations. Has dentition ever been charged with the production of croup? of bronchitis? of pharyngitis? or of laryngitis? Indeed, every intelligent physician would smile at the very possibility of it. Notwithstanding, the trachia, pharynx, and larynx are placed anatomically so much nearer the seat of the disease. Again, it must also be borne in mind that cholera infantum is by no means exclusively confined to that period of infantile life when dentition occurs. We very frequently find it in infants two, three, and four weeks old, long before dentition commences or takes place. Certainly in these we must look for some other cause than the teeth.

I quite agree with the opinion expressed by my distinguished friend, the scholarly Prof. N. S. Davis, when he said, "That the teeth probably have no more to do with the production of cholera infantum than the growth of the hair or nails."

DIET.—The diet next comes in and stands charged as a grave offender on the list of causes in the production of cholera infantum.

Now, I am inclined to the opinion that we should hesitate and at least carefully scrutinize and inquire into all the surroundings and attending circumstances before we put this down

as an exciting cause. I think, at the most, we can only charge it with predisposing. Here, as with dentition, we find the cause to be continuous, but we find that the children live, thrive, and even grow fat on the same diet all the year round, until the latter part of summer or early autumn, when, if the thermometer marks a high degree of atmospheric temperature, 70° or more, they are suddenly attacked with this disease. Most undoubtedly, insufficient and improper diet has a predisposing influence on most or all diseases. The influence is by way of debility, leaving the system in a weakened and debilitated condition, and thus less able to withstand or ward off the influence or impression of the exciting cause. Again, we have cholera infantum occurring in those very young infants long before they can or do take any kind of food, save milk, frequently when they have been watched and nursed with the most anxious solicitude, nothing allowed them but the mother's milk, and that, to all appearances, of the purest and healthiest kind. Still, when the thermometer goes up the little ones suddenly become indisposed—begin to vomit, and too often sink into a collapse and die. In these cases I think we must look to something besides the diet for that which so suddenly strikes down so many of the little ones. If the diet produces the disease, why not produce it as readily in January as July and September?

Next comes confined and impure air. I believe that here we shall find a more fruitful cause, still only a predisposing one. I have no doubt that poor and impure air is more deleterious to the economy than poor and impure food, because the human organism—that is the human laboratory—is better qualified to analyze and select the good and reject the bad in the food it takes than in the air it breathes. Further, the deleterious effects of unhealthy and impure air is more directly upon the nervous system. We are all aware, and, of course, ready to admit, that confined and impure air is an unhealthy article; very destructive of human life, unfit for either infancy or old age; that it both produces and intensifies disease, and that most, if not all, diseases thrive and fatten on filth, poverty, and impurities. But the question here is, does it produce cholera infantum? If so,

why not as much and as readily in February and March as in August and September? It is a well-known fact also that these same children live and thrive in these same localities, houses, rooms, and conditions without cholera infantum all the balance of the season, until the hot months commence—a time when the doors and windows are nearly always open day and night, thus allowing and compelling a much better circulation of air and consequent ventilation than they have been accustomed to. Again, we frequently—much too frequently—find it in the country, among our wealthiest, cleanliest, and most comfortable and exemplary living people to admit that it owes its origin to impure and confined air. I believe that even the months of August and September would be just as free from cholera infantum in the same localities providing the atmospheric temperature ranged below 60° , as January and March, because, in my opinion, there is the important factor wanting—a *high, moist, atmospheric temperature*. Let the atmospheric temperature be raised; let the thermometer mark 70° and upwards and hundreds of them suddenly sicken and die of cholera infantum, I care not whether it be in January or July.

Now it seems to me that if the above enumerated causes, either singly or collectively, are in any way competent to produce cholera infantum, they should, *and would*, produce their results as readily at other seasons of the year as during the months when the thermometer rises and ranges at 70° and above. Why not? For these and other reasons I must regard them, at least, only remote and predisposing. I think, and admit, that they may prepare the system and sow the seed, and render it more susceptible to the action and impression of the proximate cause. There is one more cause enumerated and mentioned by all writers upon this subject which I claim is the real proximate cause of cholera infantum, and therefore demands and merits our careful study and attention, namely, *a high, moist atmospheric temperature*.

We all know the effects of heat upon the living tissue, know that it is one of those imponderable agents capable of permeating and pervading all matter, whether organic or inorganic, and

its effect is to expand all bodies by causing the atoms of which they are composed to be separated further from each other. Hence, it is the great antagonistic power of affinity, whether simple, elective, or vital. Every successive addition of caloric or increase of temperature increases the expansion of the tissue, and, of course, lessens in the same proportion the vital affinity between the atoms of which the tissues are composed. Applied along the spine will induce cramps of both voluntary and involuntary muscles, increases sensibility, increases secretion, and lessens the general circulation and bodily heat. It is also well known that solar heat, applied to the head, soon produces severe headache and inflammation of the brain; applied to the spine it is very apt to cause sickness and faintness, and if continued will induce convulsions.

I am inclined to the opinion that in cholera infantum the immediate cause is excessive heat, and that its initial impression is upon the ganglionic nerve centres. That we have a correlation of predisposing and exciting causes, which I state as *the depressing and exhausting effects of heat and moisture combined, acting on a body imperfectly nourished, producing a very depressed function of the cerebro-spinal and sympathetic nervous system, or a modified or mild form of insolation or sun-stroke.*

We must bear in mind that the chief function of the sympathetic nervous system consists in regulating the diameters of the bloodvessels throughout the body; and that when the sympathetic *ganglia* are in a state of maximum *hyperemia*, the nervous effluence from them to the muscular coats of the arteries to which they are severally related stimulates them so excessively as to induce in them a condition of tonic spasm; a spasm so intense as to result in shutting off the blood altogether from a large proportion of the peripheral arteries.

We must also constantly bear in mind the fact that we are now dealing with an extremely tender age—a period when the tender little infantile nervous system is very sensitive and impressible—readily responding to any and all disturbing, predisposing, and exciting causes. In *cholera infantum*, I think

we first have paralysis of the nervous system, produced by excessive heat—frequently—applied directly to the spine. We must remember that excessive heat, applied directly to the spine, increases sensibility, increases secretion, and lessens the general circulation and bodily heat, in consequence of the arrest of the circulation in the peripheral arteries.

Dr. Condie says: "The disease is evidently dependent for its production upon the action of a heated, confined, and concentrated atmosphere directly upon the skin, and indirectly upon the digestive mucous membrane, at an age when the latter is already strongly predisposed to morbid action from the effects of dentition, and from the increase in the development and activity of the muciparous follicles, which takes place at that period. The influence of a high atmospheric temperature in the production of cholera infantum is shown by the fact that its prevalence is always in proportion to the heat of the summer—increasing and becoming more fatal with a rise of the thermometer, and declining with the first appearance of cold weather in the autumn. A few hot days in succession in the month of May are sufficient to produce it; while, during the height of its prevalence, a short period of cool weather will diminish, if not entirely suppress it."

Drs. Eberle and Mitchell say: "High atmospheric temperature is manifestly concerned in the production of this dangerous complaint. It commences with the hot weather, increases and becomes more fatal with the rise of the thermometer, and declines with the cool weather in autumn. During its continuance, it may be observed with every permanent change of temperature. A few very hot days in succession in June are sufficient to call it into action, and during the height of its prevalence, a spell of cool weather will diminish, if not suppress it." Dr. Jacobi says: "For if there is anything to which we owe our great amount of intestinal *catarrh*, it is paralysis of the nervous system from heat."

Now let us inquire into the general conditions and surroundings of these very young and tender infants and children. We find that they are not only subjected to the prostrating

effects of the prevailing high atmospheric temperature during the hot season; but they are generally confined to the rooms, and placed either in their cradles, with their spines and backs buried in a feather pillow, or on their mothers' laps, and thus compelled to suffer from that concentrated heat applied directly to the spine, besides that reflected from the walls of the apartments, and the exhalations from the individuals who have care of them, and with whom they are in close personal contact. These conditions, please remember, are generally applied during that period of infantile life when the child is subject to cholera infantum. How different, indeed, are the conditions and relations of older children in comparison with those of an infant of more tender age; instead of being kept in constant confinement, buried in a hot pillow, or held closely in the arms of the overheated and perspiring mother, the bold little boy and the lively rosy-cheeked girl may enjoy themselves heartily in the open air, playing around in every possible manner for the most part of the day.

Now, when we adopt the theory of Virchow, "that the bloodvessels receive two classes of nerves—one belonging to the sympathetic, and the other to the cerebro-spinal system. That the office of the sympathetic fibres is to cause contraction of the bloodvessels, whilst that of the cerebro-spinal fibres is to cause their dilation. Then, when from heat applied to the spine, or from any other cause we receive a shock *or an impression* sufficiently severe to paralyze or disable the spinal fibres, the dilators of the bloodvessels, then the sympathetic constrictors, freed from all restraint, will cause contraction of the vessels and a fall of temperature. This I conceive to be the physical condition in the onset of cholera infantum. The depressing and exhausting effects of heat and moisture combined, acting upon a body imperfectly nourished, has paralyzed or disabled the spinal fibres, the dilators, and the sympathetic fibres; the constrictors, freed from all restraint, have caused sudden contraction of the bloodvessels, thus forcing the blood into the capillaries; producing engorgement or *hyperemia* of the capillaries of the

mucous membrane, and especially of the intestinal tube, which during this early period of infantile life is peculiarly sensitive and preternaturally susceptible to any and all morbid impressions and disturbing causes—because of its activity in the rapid physiological development of the muciparous follicles of the intestinal tube. We have produced a hyperemic condition, or what Profs. Samuel, G. Armor, and Niemeyer would call or denominate “an intestinal catarrh.”

This engorgement, or *hyperemia*, does not result in actual inflammation, because it takes place under an extremely depressed nervous condition, and, therefore, only produces an abnormal secretion and copious generation of young cells. These cells, however, are not permitted to approach the free surface—there to become dried, compressed, and elongated into flattened, cylindrical forms of pavement epithelium; but, under the spur of excitement of this hyperemic condition of the intestinal mucous membrane, they are prematurely moulted off in every state of development—many of them born before their time—and, as Prof. Armor has pleased to express it, “infant tissues strangled in their birth;” producing a very copious fluid secretion, which, by reason of the diminished vital affinity and consequent relaxation of the tissues of the mucous membrane, admits of an equally rapid effusion or exudation of the serous part of the blood. The processes denominated and classified catarrhal are all quickened; the cellular elements of the blood-plasma are thrown too rapidly on the free surfaces to form any of the usual inflammatory products—such as suppurative inflammation, croupous inflammation, or diphtheritic inflammation—and thus furnish the matter for the copious thin, watery discharges.

This rapid loss of the watery elements of the blood arrests or speedily diminishes the glandular secretions, retards organic or molecular changes in all the tissues, thereby diminishing the evolution of caloric, and causes a marked and rapid shrinking of the whole body, because the current of blood serum is absolutely essential to the life and development of cells. It acts in two ways, first as a mechanical stimulant, and second as material

of nutrition. The morbid sensibility of the nervous filaments involved in the mucous membrane of the stomach and intestinal tube, acted upon by the effused fluid, calls into action a reflex influence upon the muscular coat, and thereby establishes the frequent efforts at purging and vomiting to evacuate the stomach and bowels. Such, in my opinion, are some of the pathological conditions which constitute the onset and active stage of cholera infantum. Of course this condition of things cannot exist long without other grave and important pathological changes. The arrest of the usual and necessary organic or molecular changes cannot be tolerated by the economy. Further and equally as important pathological changes must follow in rapid succession, and we soon have other and entirely different phenomena manifesting themselves in the *sequela* of cholera infantum. The intensity and severity of the attack varies very much in different cases, according to the idiosyncrasy of the patient, and the conditions and surroundings. The very initial impression or shock may be so severe as to destroy life in a very short time, without producing any or all of the above changes: that is, the impression or shock may be so extensive and profound as to produce depression of all the vital functions to entire obliteration. We sometimes meet cases—I have met many such—where the child, while in the enjoyment of apparent good health, without any premonitory symptoms, is suddenly attacked, at once becomes blue, cold and clammy, vomits once or twice, has an evacuation or two from the bowels, then becomes pulseless, and sinks rapidly into collapse and dies. These cases do not die from any drain upon the blood, nor waste of tissue. The impression is upon the ganglionic nerve centres. They die directly from shock, from nervous exhaustion; the nervous fluid is annihilated, the impression is so profound as to produce depression of all the vital functions to obliteration.

In another class of cases the initial impression is less severe; the *hyperemia* and its catarrhal conditions, its desquamative and exudative processes ensue, purging and vomiting in a less violent degree follow and continue, when soon other changes manifest themselves. The continuance of the serous discharges

more or less rapidly drains and exhausts the blood, which now becomes also chemically changed, and thereby less able to sustain the vital energies. The effect of these drains, when they are more than the system can simultaneously repair, is very great, for the vital function then becomes both depressed and depraved, and suffice to determine other and grave states of disease. There is no doubt but this blood-poison is generated within the body itself, by concurrence of external causes, influencing especially the physiologically vicarious, yet collaborating organs, the skin and the kidneys. Under the depleting and depressing influence of these evacuations the countenance becomes pale and contracted, the eyes sunken, the pulse small, quick, and frequent, the extremities cold and shrunken, the urine scanty or entirely suppressed, and the mind lethargic, with spells of great restlessness. The little patient continues to emaciate very rapidly. The vital drain is more than the remaining recuperative powers of the system can simultaneously repair, and the vital functions become both depressed and depraved, and they sink into fatal exhaustion. This condition obtains much more rapidly in children than adults, for the latter have but to reproduce the elements of their bodies, while the children have both to produce and steadily increase. Thus the lack or waste of material is badly borne by children.

That we have now to contend with a depraved as well as a depressed condition of system, I think, is fully proven, and evidenced by the character of the discharges. The color and the character of the intestinal discharges varies, being sometimes green, at others yellow, and again white. They also vary very much in consistence and odor, being at times thin as water and almost as odorless, and at others only semi-fluid, frothy, and extremely offensive. When these discharges are examined under the microscope they are found to be largely made up of altered blood-plasma, epithelial cells, mucous, and young blood cells, from the surfaces of the mucous membrane, in every stage of decomposition. In many of these cases, in addition to the exhaustion and rapid emaciation in the advanced stage, there ensues a constant vigilance or wakefulness, with rolling of the

head, tossing of the hands, accompanied with frequent sighing, screaming, and moaning. There is now a rapid disintegration of the nervous as well as other tissue, with its consequent arrest of nervous as well as vital energy; an arrest or suspension of the organic or molecular changes necessary to sustain life. They finally sink into a comatose state and die from vital exhaustion. Coma, from exhaustion, is a fearful thing, and should always be guarded against with vigilant care. It is a condition too often lost sight of, the practitioner too frequently interpreting the stupor as meaning congestion of the brain, while, in fact, the brain is extremely anemic. There is still another class of cases where the onset of the disease—that is the initial impression is less severe, but much more protracted. There is not as much nervous depression, but more or less fever from the commencement. There is an unnatural influx of blood into the capillaries of the mucous membrane of the intestinal tube, but the nervous impression and consequent depression being less profound there is less general exhaustion and relaxation of the capillaries and tissues, which in the other severer cases produced and allowed the rapid exudation and consequent escape of the fluids and watery elements of the blood, constituting those profuse, copious, serous, and terribly exhausting discharges. Although the efforts at vomiting and purging may be very severe, the quantity of fluids actually evacuated is not large, and is found to consist very largely of mucous, indicating the existence and tendency of an inflammatory action. There is early an earnest attempt at reaction, and in those cases where the discharges are arrested or cease before exhaustion or collapse ensues, rest and a judicious replenishment of the blood by liquid nourishment soon restores the patient; but in many the reaction passes the healthy standard, and another pathological state is developed. Although the capillary circulation in the mucous membrane and consequent organic or molecular action in the tissues have been but partially arrested, still the impairment or destruction of the texture in portions of the intestinal mucous membrane is such that the capillaries are incapable of resuming their circulatory functions properly, hence

the impoverished and impaired blood accumulates in them, producing a hyperemic condition, which is followed by a slowly oozing of the elements of the blood, which, mingling with the retained urea, lactic, and other acids in the alimentary canal, give rise to the peculiarly offensive, bloody, and *green* discharges in these cases. The essential characteristics of these discharges are that the catarrhal action has been of a less active character than in the preceding cases. They are the products of a comparatively slow inflammatory process. The disease approaches nearer a suppurative inflammation than in the other cases; that is, the elements of the blood instead of being poured into the alimentary canal in a rapid and almost continued stream find their way there in this slow oozing process. These *green* discharges when examined under the microscope are found to contain altered blood-plasma, epithelium, mucous, and young blood-cells, in various stages of disintegration, colored by the lactic and other acids, secreted by the mucous membrane. The glandular secretions and discharges become arrested; there is a partial or complete suppression of the urine; the discharges from the bowels become smaller, more frequent, and streaked with blood; the child exhibits more signs of pain; the skin becomes hot and dry; the lips parched; the pulse more firm, quick, and frequent; and the little patient very fretful. Their little limbs become attenuated, the muscles soft and flabby, the skin hangs in wrinkles about their necks and limbs. Whatever food or drink is taken is promptly rejected. Sleep is disturbed or out of the question, consequently the little patients continue rapidly to emaciate, and usually reach the stage of fatal exhaustion in from one to four or six weeks. This rapid loss of flesh goes on until the child is reduced to a degree of emaciation as great as is ever witnessed even in the most advanced stage of mesenteric disease or pulmonary consumption. The nutritive and assimilative functions seem to be nearly obliterated. That portion of the nervous system that presides over the nutritive functions-supplies the affinity for the elements of the blood requisite for its nourishment and functions is disabled, and they virtually die of starvation.

POST MORTEM.—With regard to *post mortem* appearances, there has been much apparent discrepancy of description. The explanation of this discrepancy is found easily in the fact that death may result in any stage of the disease. It thus becomes quite difficult at times to discriminate the incidental complications from the primary original affection. If the patient die in the first stage, within a few hours from the attack, there will be found no signs of local change. The disease is capable of killing the patient speedily or slowly, and yet leaving behind no trace of its footsteps, leaving but little if any footprints behind for morbid anatomists. Here as elsewhere the fact is plainly demonstrated, and teaches unmistakably that the immediate organic or molecular changes upon which life and death depend are intrinsically beyond the sphere of our aided or unaided observation. We necessarily infer their existence precisely as we infer the reactions of a chemical compound, by observing the results of things which we can see, handle, and weigh.

I think it will be better for us to be honest and admit that the cause of death in many grave and fatal diseases is still buried in the deep, dark mysteries of the nervous system and its vital phenomena. In common with many other potent influences which suddenly strike down the powers of life, the cause or causes of cholera infantum may and do produce at once symptoms so profound that particular manifestations of the special proximate cause will not take place. In my opinion, in the first-named class of cases an overwhelming cause, which I claim to be heat and moisture combined, acts especially upon the cerebro-spinal centre, and secondly upon other organs. Probably all observable lesions are truly secondary.

Dr. Copeland says: "The appearances after death clearly show that this disease consists of inflammatory irritation often rapidly passing into inflammation of the greater part of the mucous surface of the stomach, and of the small and large intestines, frequently accompanied with depressed vital energy of the frame, congestion of the liver, and a morbid state of the abdominal secretions, and occasioning sympathetic disorder either of the functions or of the substance of the brain and its membranes."

Dr. Flint says: "After death an examination reveals the evidences of inflammation of the mucous membrane of the small, and, perhaps, also of the large intestines, the follicles being especially involved."

Dr. Tanner says: "*Post mortem* examinations have thrown but little light on this disease. As one of the foci of the morbid action, we naturally look first to the gastro-intestinal mucous membrane, but beyond distention of the follicles we find nothing. The symptoms, moreover, indicate great exhaustion of the ganglionic nervous centres, while there is also a marked loss of tone in the capillary circulation."

Dr. Watson says: "The lesions exhibited by *post mortem* examinations of those who have died from cholera infantum vary according to the period of the disease when death takes place. When the disease has been of short continuance the mucous membrane of the alimentary canal has been occasionally found of an abnormal paleness, and the liver more or less congested. When the case has been of a more protracted character, increased redness and points or patches in different parts of the stomach and intestines is often present. The red points are sometimes very minute and isolated, and spread over a considerable portion of the stomach and duodenum, or over the small intestines only. They have the appearance generally of minute extravasations of blood. In the lower intestines the points occur in clusters, so as to form patches or bands of redness, varying in size, though never of any very great extent, and often slightly elevated from a thickening of the mucous tissue at the points occupied by them. Occasionally portions of the mucous membrane are more or less softened, often without the slightest inflammation. In other instances, increased redness of some portion of the intestine exists, with contractions, often the extreme of its calibre. The muciparous follicles of the intestines are very generally enlarged, often in a state of inflammation, and occasionally of ulceration.

Dr. Wood says: "If death takes place early, an unusual paleness of the mucous coat and more or less hepatic congestion are the only morbid appearances discoverable. At a more advanced

stage often there is generally some indication of inflammation, the mucous membrane of the stomach and bowels exhibiting more or less redness in points, and an increased development of the glandular follicles."

Drs. Eberle and Mitchell say: "When death takes place early in violent and rapid cases the vessels of the liver, stomach, and intestines are found, on dissection, engorged with blood. The mucous membrane of the bowels generally exhibits traces of inflammation, and when the disease has continued for a considerable length of time, ulceration and abrasion of this structure are occasionally met with. In some instances considerable portions of the intestinal tube are so much contracted as scarcely to admit a small quill. The liver, besides the engorged state of its bloodvessels, is often greatly enlarged, particularly in cases of long continuance, and this enlargement is usually attended with a manifest increase of the firmness and denseness of its structure."

Dr. Condie says: "The examination of the bodies of those who have fallen victims to cholera infantum exhibits various lesions, chiefly of the alimentary canal. When death occurs early in the attack, the only morbid appearance discovered is often an unusual paleness of the mucous coat of the stomach and the intestines, with more or less congestion of the liver. When the disease has continued for a longer period, increased redness in points or patches in different parts of the intestines and stomach is often present. In the second or more advanced or chronic stage, the anatomical characters consist essentially in inflammation, with softening of the mucous membrane and ulceration of the follicles, more especially of the large intestines. Cholera infantum, comparing the symptoms during the lifetime of the patient with the appearances discovered after death, would appear to depend in its earlier stages upon a *hyperemia* of the mucous membrane, with augmentation in the size and in the activity of function of the muciparous follicles of the alimentary canal, inflammatory action being excited in the course of the disease, as well in the follicles as in the mucous tissue, from accidental sources of irritation."

Dr. Brown says: "Pathologists appear to be united in the opinion that there is present, at first, merely an enlarged condition of the mucous follicles, with irritation of the mucous membrane, and congestion and enlargement of the liver. At a more advanced stage, inflammation of the gastro-enteric mucous membrane, with sometimes ulceration and softening."

Dr. West says: "In proposing at the commencement of this lecture to distinguish between simple and inflammatory diarrhoea, I yet was forced to acknowledge that the distinction was rather of degree than of kind, or perhaps it would be more correct to say that our observation has not hitherto been minute enough to enable us to draw the line of demarcation strictly between the two affections. Even MM. Rilliet and Bath, whose opportunities have been so extensive, and whose industry is so untiring, confess their inability to refer the symptoms that attend upon the different varieties of diarrhoea to any distinct and invariable anatomical lesions. They remark that not merely are exceedingly different appearances discovered after death, in cases where there is often no proportion between the intensity of the two, and that sometimes no morbid appearances are found, even where well-marked symptoms had existed. These circumstances prevent our deducing from the results of anatomical investigation those practical conclusions which we should otherwise be inclined to draw from them, but they do not warrant us in altogether omitting to inquire what changes we shall be most likely to meet with in cases of fatal diarrhoea. In those cases in which the structural alterations have been least considerable, the attention is arrested less by any great increase of vascularity in the intestine than by the remarkable distinctness of the orifices of the solitary glands, which appear like almost innumerable dark spots upon the surface of the mucous membrane. In many cases, and especially in those in which the diarrhoea was very profuse at the time of the patient's death, not merely are the openings of these follicles unusually distinct, but the glands themselves are enlarged and project like small millet seeds or small pin heads beyond the level of the surrounding tissue. It is true that the observations refer to children above two years

of age, and to cases in which diarrhoea has been protracted, but my own observations would lead me to believe that a similar statement might be made with reference to younger children."

THE LIVER.—Dr. J. Lewis Smith, Curator of the Nursery and Child's Hospital, has published some interesting investigations, which confirm unmistakably the prevalent belief that the liver plays an insignificant part in the pathology of cholera infantum. He gives the result of the *post mortem* appearances of the liver in 57 cases. No evidence is offered by these, or either of them, of any congestion, or torpidity, or hyper-activity, or perverted secretion, or abnormal size of this organ. The liver was examined microscopically, and the only fact worthy of note, if any, observed, was the variable amount of fatty matter.

Thus it is seen that there is a very marked discrepancy in the *post mortem* and anatomical appearances after death, as described by many of the most eminent writers on the subject. I believe, however, that a majority of the late writers and observers admit and agree that in the first class of cases—those who die within twelve or twenty-four hours from the attack—they find very little, if any, anatomical changes. I think the statements of Drs. West and Condie significant, and pointing to an important conclusion.

My theory is: That many of the second and most of the third class of cases occur in the older children, in those that are from one year to two years old and upwards. In them we have a slower and an inflammatory action. They have not been subjected to so concentrated a noxious influence. They are older, and therefore not confined upon their backs on a hot pillow or cushion, nor their mother's nor attendant's laps, and thus do not have the same concentrated heat applied directly to their spines and backs. They are able to sit up, play about the apartment, are more frequently taken out into the open air in their cabs or carriages; consequently, the initial impression in their cases is less severe. The extreme nervous depression and consequent trans-udative *hyperemia* or catarrh of the intestinal mucous membrane does not ensue; they are more prone to the less active form of the catarrhal disease, such as the last de-

scribed, together with dysentery and the inflammatory varieties.

TREATMENT.—It would indeed be a happy circumstance if the treatment were as satisfactorily determined as even the character of the disease. Unhappily this is not the case. We have to deal not with a Greek or Latin name, nor with a parasite that is to be simply expelled, but with a living tissue of a single individual, with special dispositions, resources, and idiosyncrasies. All enlightened medical men have ceased to regard diseases as entities, and, therefore, no longer rely upon routine treatment. The diagnosis of names has yielded place to the search for causes and conditions, consequently treatment has been placed upon a broader and more certain basis. Our journals are more than ever filled with hypotheses to explain morbid symptoms or the action of remedies, and these, very generally, point in one direction. The mechanical and chemical views of disease, which in different phases have so long kept the field, are everywhere being abandoned for others in which the nervous force is the primary assumption. Even those diseases which, but a short time ago, were thought the best illustrations of the chemical pathology, are now believed to have their seats in the nervous system. The forces of the inorganic world are mutually convertible into each other, and each into all, and the forces of organic life are correlated with the physical forces. There is, in fact, an absolute unity of force in organic and inorganic nature.

Dr. Tourtellot, of Utica, N.Y., thinks the "Change promises to be one which will bring medical doctrines thoroughly into accord with the science and philosophy of the times." He says: "It evidently belongs to the great movement in scientific thought, which is marked by the doctrine of the correlation of forces. When all the physical sciences have been brought together in a doctrine of abstract force, it is certainly not to be wondered at that vital action shall not longer continue to be interpreted by the principles of chemistry."

The nerve masses contain gray and white matter, the organic electro-magnetic batteries evolving organic force. The nerve cords, containing only white matter, are the telegraphic wires,

conductors of force only, or perhaps, more properly, force and impressions. Virchow has done much towards turning the attention of the medical world in this direction. Dr. Chapman, of Farringdon, now claims, "That every gland and glandular follicle in the body is under the control of one motor nerve, emerging from the cerebro-spinal system, and distributed to its secreting cells, in order to regulate its functional activity; and of another motor nerve, emerging from the sympathetic, and distributed to its arteries or arterial twig, in order to regulate its blood supply. That in the same manner as glands are supplied with positive as well as with negative motor nerves, so there is reason to believe every tissue of the body is thus supplied, and is thus placed and sustained in a state of elective affinity, for the elements of the blood requisite for its nourishment and functions."

If this be true, how important, then, that we pay particular and proper regard to the nervous system in all our examinations and prescribings for disease—especially in cholera infantum—as, according to my theory, that the initial impression be upon the ganglionic nerve centres, we must first attempt to remove the cause, and thus prevent the arrest or suspension of those organic or molecular changes so essential and necessary to sustain the powers of life. In my judgment, cholera infantum kills in three ways:

First. Where the initial impression upon the nerve centres is so profound as to produce depression of all the vital functions to obliteration, when death rapidly follows.

Second. Where the initial impression is less profound and followed by the hyperemic and catarrhal conditions of the intestinal mucous membrane, producing copious, serous, and exhaustive discharges—leading to collapse and exhaustion—or coma and death from exhaustion.

Third. Where the catarrhal symptoms are less active, and a sub-acute inflammatory action ensues, with its slow oozing of its elements of the blood, and an arrest of the nutritive and assimilative functions, death from inanition or starvation.

Now, how are we to arrest a fatal termination in these cases?

I frankly admit that I think we shall always have a large mortality list in the first class of cases.

First. Because they occur mostly in very young children, that are subjected not only to the prostrating effects of the prevailing heat of the season, but also to that concentrating heat from hot pillows, cushions, or that radiated from the overheated persons of attendants, as well as that reflected from the walls of the apartments.

Second. Because death ensues so rapidly after the attack that we do not have time to get the effects of either preventive or remedial measures. I think with Prof. Jacobi, "That we ought to insist upon the public's learning that we cannot pull the stars from heaven."

Our first object should be, as far as possible, to remove the exciting cause. I apprehend that we can accomplish quite as much by bettering the surroundings of the patient, together with external applications, as with the administration of medicine. It is all-important, the moment the infant is attacked with cholera infantum, that it be removed from the heated, concentrated, and confined atmosphere by which the disease has been generated, to a situation where it may enjoy the advantages of free ventilation and cool air. The room occupied by the patient should be as large and airy a one as can be commanded. They should be placed upon a mattress, or on a blanket folded and laid upon the sacking bottom of the bedstead, or upon the floor of the crib, the body being defended by a light, loose covering. The next important indication is to awaken the action of the nervous system. How can this best be accomplished? By the use of external stimulants—rubefacients. Whatever will powerfully stimulate the surface, especially along the extremities. This, not from any vague idea of internal pressure or congestion, to be overcome by determining to the surface, but for promoting organic or molecular tissue changes in this most accessible of the excretory organs, and thus awaken energy of circulation and renewal of blood. The rubefacient becomes thus a general stimulant. With capsicum, mustard, ammonia, terebinthines, pungent oils, and friction—the means are

abundant enough, and the practitioner can take his choice. But let it be attentively observed, to be useful, the action of the surface *must be awakened*, and not merely irritated. Persistency, and yet extreme caution not to destroy the tender tissue, must be the cardinal point in view. Another very potent and convenient external stimulant is the application of ice for a few moments, and then the alternation of hot epithems—this alternation to be frequently repeated. The ice-bag to the spine is, indeed, a powerful awakener of nervous action.

Dr. John Chapman, of the Farringdon Dispensary, published some very interesting experiments with this remedy. A formidable-looking remedy, but when judged by the light and aid of experience, it ceases to terrify, and, on the contrary, is found decidedly mild and agreeable. Dr. Chapman says: "Ice applied in bladders or by any of the ordinary methods would undoubtedly occasion great discomfort, but the application of ice along the spine, in the spinal ice-bag expressly devised for this purpose, is liable to none of these objections. Great care must be taken that the application does not extend far on each side of the spinal cord, otherwise the patient will become cold."

He has used it extensively in arresting the terrible vomiting, purging, and deathly sickness in sea-sickness. He refers the deadly palor, the physical weakness, mental prostration, and indifference, which, in degrees ranging from mere *malaise* to such vital depression as to imperil life itself in this disorder, to a hyperemic condition of the sympathetic nervous centres. He gives the following examples:

CASE I.—She, a very delicate lady, felt the cold to the back peculiarly grateful, but wished it more intense. The bag was therefore placed next the skin. This change delighted her.

CASE II.—In about ten minutes after the vessel started she became violently sick. I applied ice along the entire spine as quickly as possible, when she was immediately and instantaneously relieved, and then lay down upon the ice—soothed, calm, and warm.

CASE III.—After lying upon the ice a few moments, her sickness and headache ceased entirely.

He gives seventeen cases, in all of which the effects were as prompt and soothing as in the above. He also publishes several cases where its powers of awakening nervous action and peripheral circulation is clearly illustrated in the treatment of diseases of the eye.

Dr. Ernest Hart corroborates these cases, and also himself publishes several cases in the LONDON LANCET, where he experimented on cases of amaurosis from progressive atrophy of the optic nerve, with epileptic complications, treated successfully by applications of the ice-bag to the spine. He says: "At the beginning of the treatment they could read no type smaller than No. 10 of Giraud-Tenlon. They now read No. 4 with ease. The pupils are no longer dilated, although they act sluggishly. But a point of great interest is, that the disks are now of a tint which may be pronounced natural; they are purely roseate. * * * * From a physiological point of view, this is remarkable as an example of visible regeneration, so to speak, of a nerve in process of wasting from disordered nutrition. Nothing else than the ophthalmoscope could have shown it, and nowhere but in the eye could it have been seen, for nowhere else is a living nerve subject to observation."

Dr. Geo. Johnson, physician to King's College Hospital, in speaking of the formidable disease known as sun-stroke, or heat-apoplexy, says: "The one essential and constant condition is a very high temperature of air of overcrowded rooms. All modern pathologists are agreed that the super-heating of the blood, which precedes and accompanies this disease, has a depressing, and not a stimulating effect on the nervous centres, producing paralysis of the motor fibres, and thus relaxes the muscular walls of the arteries; and the proper treatment to arouse the nervous action and overcome the capillary congestion is ice applied to the spine by means of a spinal ice-bag."

I have been thus particular to quote these authorities in order to show the established power of the ice-bag to the spine over this peculiar condition of the nervous system. It is claimed by all of them that cold, applied in the shape of ice-bags along the spine, will awaken nervous action, subdue excessive tension of

both voluntary and involuntary muscles; will lessen sensibility, lessen secretion, and increase the general circulation and bodily heat.

Now, if this can be done in the commencement of the attack of cholera infantum, the nervous action kept up, tissue changes kept up, by increasing the peripheral circulation, the disease may be arrested without the administration of much medicine internally. Proper liquid nourishment must be liberally supplied and cautiously regulated, according to the necessities of each case. If possible, they should be confined exclusively to the breast; because the mother, when in good health, supplies a nourishment which no science can equal and no art compound; or, if weaned, to such a diet as will most nearly correspond to the mother's milk. Internal stimulants, if administered at all, must be administered with great caution. I regard alcohol rather as a sedative and an antiphlogistic than a stimulant.

Murchison regards it as "a very volatile stimulant; gives it in cases of paralysis, particularly paralysis dependent upon functional weakness of the nervous centres." He thinks it acts especially upon that portion of the nervous system which serves as the inhibitory centre of circulation and temperature.

Prof. Jacobi says: "As a stimulant, I give alcohol for its anti-paralytic effect. I may say that I regard it as a dietetic agent, and in the hot summer weather I make all my children take a little whiskey or brandy in the water they drink. For if there is anything to which we owe our great amount of intestinal catarrh, it is paralysis of the nervous system from heat, and I find those children who take a little brandy or whiskey to counteract this, every hot day through the summer, escape these bowel complaints, and do very much better."

I am not quite satisfied with classing alcohol as simply a stimulant. I think it has a double action—permeates and pervades all tissues, comes in direct contact with the nervous filaments, arouses the nervous system to action, either through a stimulating or tonic action, and thereby increases the peripheral circulation, and also exercises an antiseptic action, arresting or preventing the destructive metamorphosis of tissue. But I do

not intend to deal in prescriptions nor special remedies in this article, only point out general measures.

In the second class of cases, the danger is from exhaustion. The object of treatment here should be from the commencement to counteract this tendency. The same external measures recommended in the other cases are equally applicable, and also indicated here. I think them more amenable to treatment, still I do not believe in specifics. Use such remedies and measures as the symptoms seem to demand. Besides the external applications, the demand in the majority of cases is for nutrition. Support and stimulation are everything in this exhaustive tendency. Our first aim should be to awaken and maintain nervous action, prevent the copious discharges. This can better be accomplished by keeping up organic actions than by attempting to simply check the diarrhœa and vomiting. The third class of cases demand less active measures, less medicine, more tonics, more stimulants, more and better nourishment. In them there is a slow but constant waste. The organic, the nutritive, and assimilative functions are arrested, and they are slowly starving in the midst of plenty. They need to have their digestive and assimilative functions aroused. This can only be done by awakening and keeping awake the nervous system. They need plenty of fresh, cool, pure air, bathing, friction, nourishment, and tonics. Our first aim should be to introduce as quickly as possible the largest possible amount of food. When I say "introduce," I do not mean thrown in, or yet swallowed, but assimilated into the system. Give them milk, ice, or teaspoonfuls of ice water, iced milk, beef essence, brandy with beef essence, white of eggs beat up with lime water, finely-hashed raw meat, etc. I repeat, these things are not to be "thrown in," but given cautiously, frequently, and as regularly as medicine, in small divided doses, oft-repeated during the day. Remember that if the loss is to be repaired, the means of repair must be given.

MEDICATION.—Gentlemen, I repeat I have no special favorite drugs to recommend. The various mammoth and magnificent drug stores of the country are filled with an endless variety of

elegant preparations for you to select from. Mark you, I say there are no specifics; you must treat each individual case by itself and for itself, according to its symptoms and indications. Be careful and do not *treat them too much*. Let the sin be one of omission, rather than of commission. Keep the babies, especially their backs and spines, from getting too warm, and see that they have plenty of pure, healthy air; sufficient clean, healthy, digestible, and appropriate nourishment; and perhaps *they will live*.

